JPL

Ice Sheet System model

What ISSM cannot do (yet)

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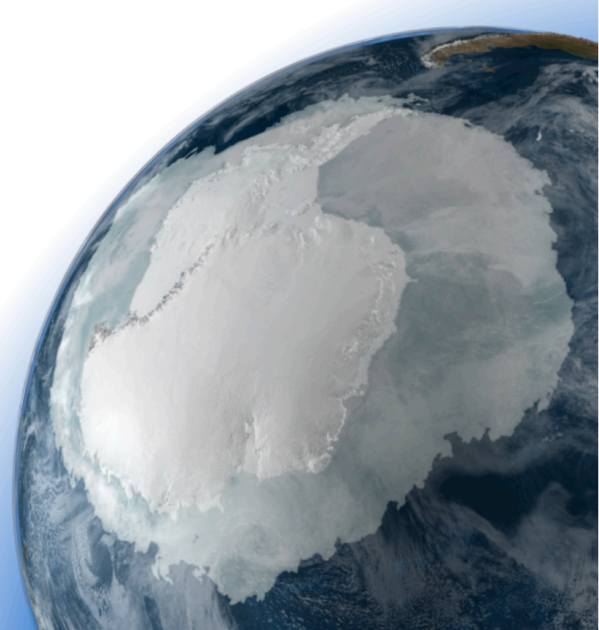

ISSM

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Outline

1. Ice models
2. Basal conditions
3. Inversion and data assimilation
4. Ice/atmosphere interactions
5. Ice/ocean interactions
6. Other capabilities
7. Numerics

Missing capabilities
Larour et al.
Ice models
Basal conditions
Inversion and data assimilation
Ice/atmosphere interactions
Ice/ocean interactions
Other capabilities
Numerics

Ice models

- Ice anisotropy not included (ice fabrics)

→ Ice considered isotropic

- Cold ice model used in thermal model

→ No polythermal ice

- Moving grounding line based on hydrostatic equilibrium

→ Not implemented for full-Stokes (based on contact mechanics)

- Ice front and margins fixed in time, no calving law

→ Calving rate equal to ice velocity

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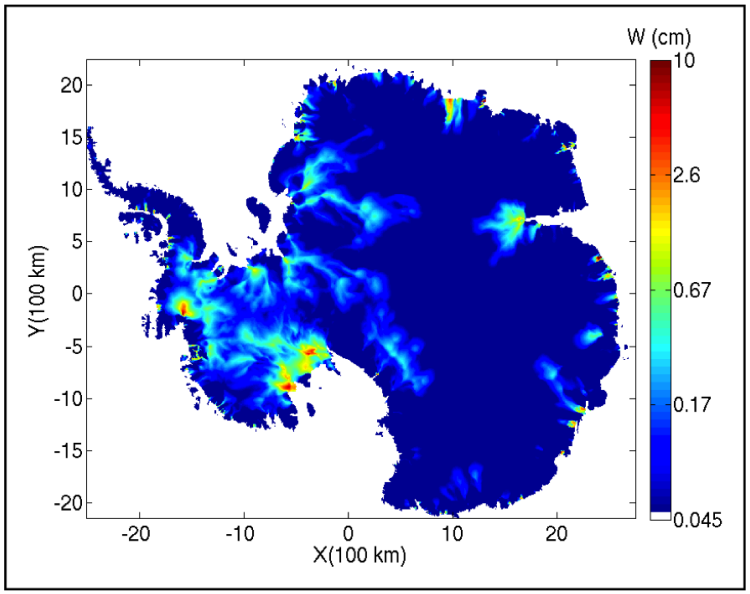
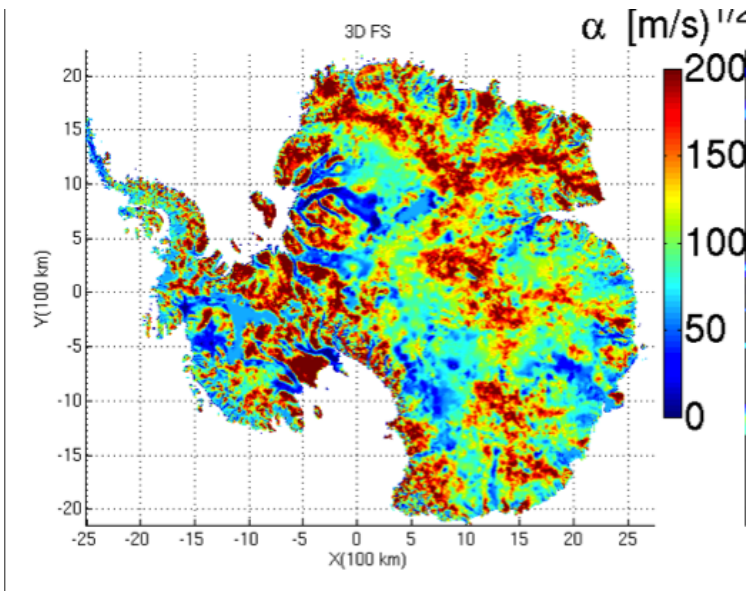
Basal conditions

- Basal friction fixed in time
- Hydrology not coupled to basal friction
- Sub-glacial hydrology only

→ No englacial hydrology





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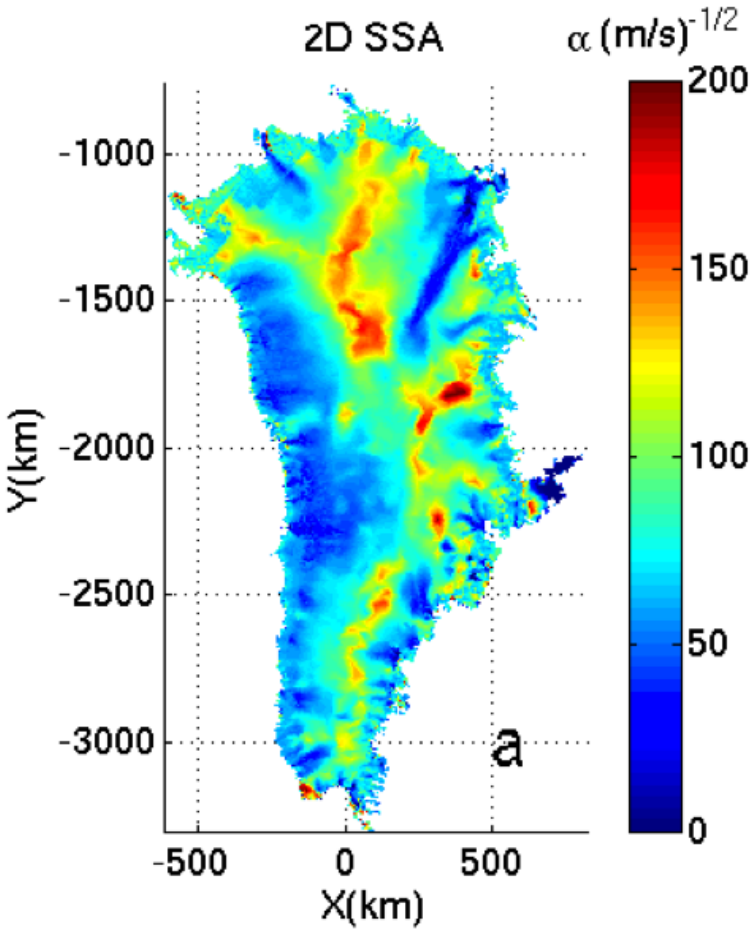
Inversions and data assimilation



Inversions limited to:

- Ice rheology
- Basal friction
- Ice thickness consistency with velocities

→ Assimilation for a given time

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Larour et al.
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Ice/atmosphere interactions

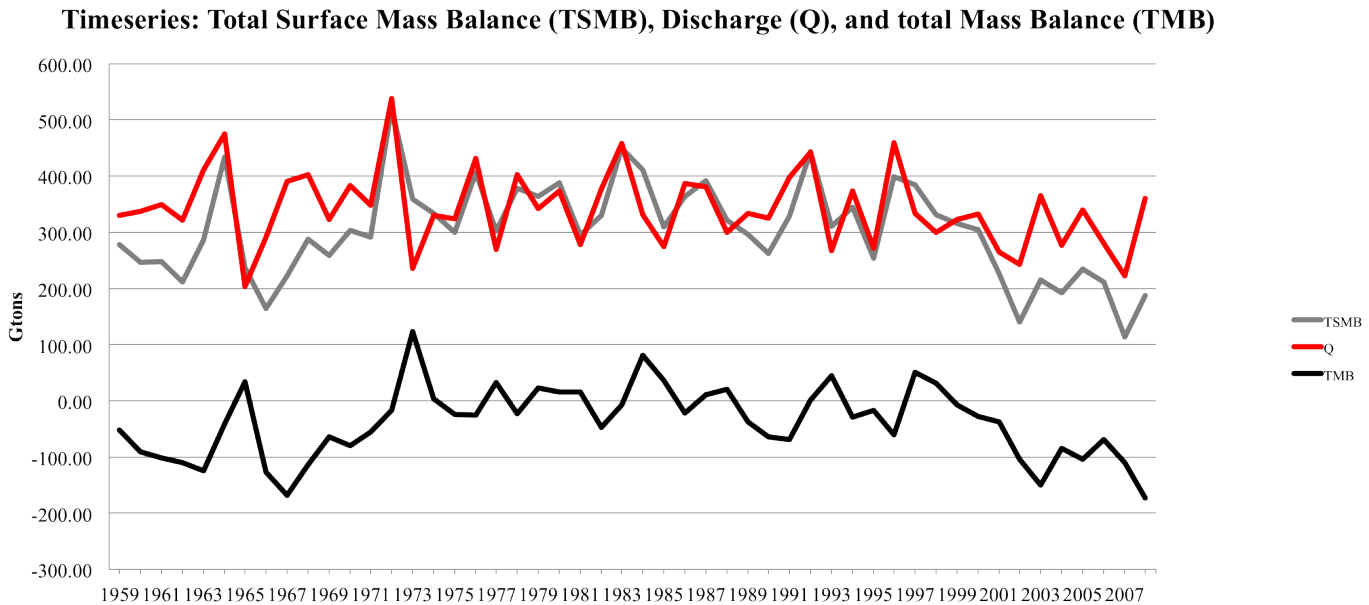
Interaction between ice and atmosphere not modeled

- Surface mass balance transformed into ice

→ No PDD model (Positive Degree Day)

- Snow instantaneously transformed into ice

→ No firn compaction



Schlegel et al., in preparation

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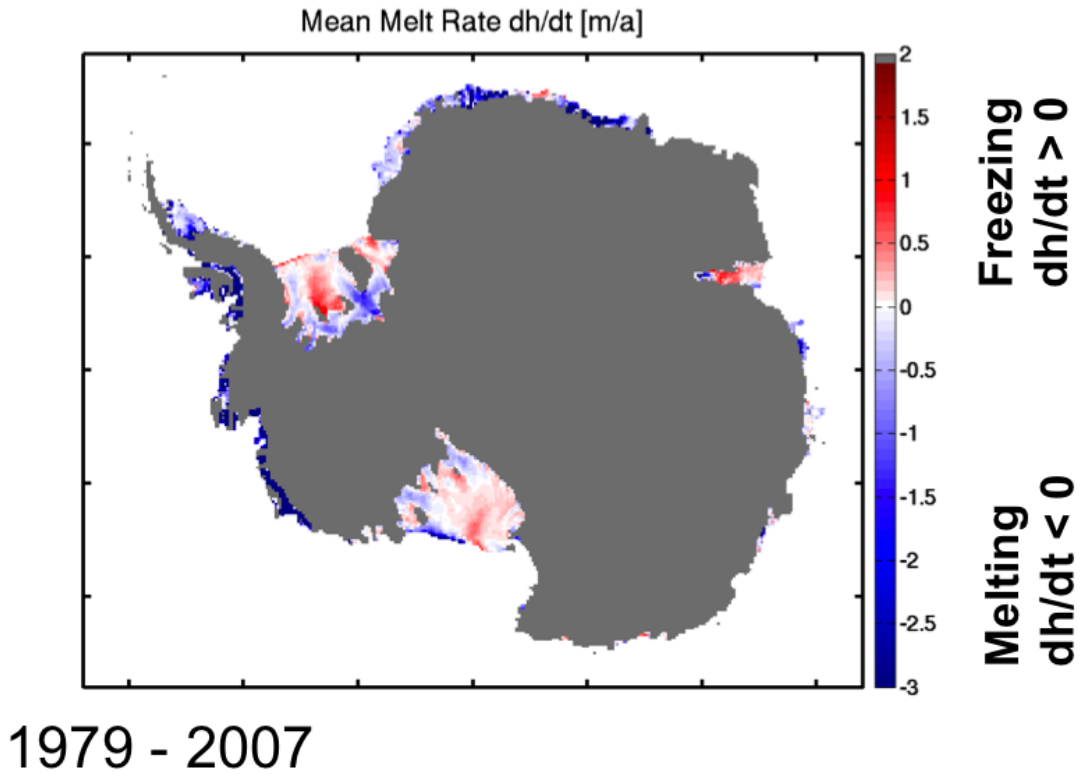
Ice/ocean interactions

Interaction between ice and ocean not included

- Melting rates under ice shelved prescribed
- Sea level fixed at $z = 0$

$\rightarrow$ ECCO3 project to couple ocean and ice models



1979 - 2007

Schodlok et al., submitted

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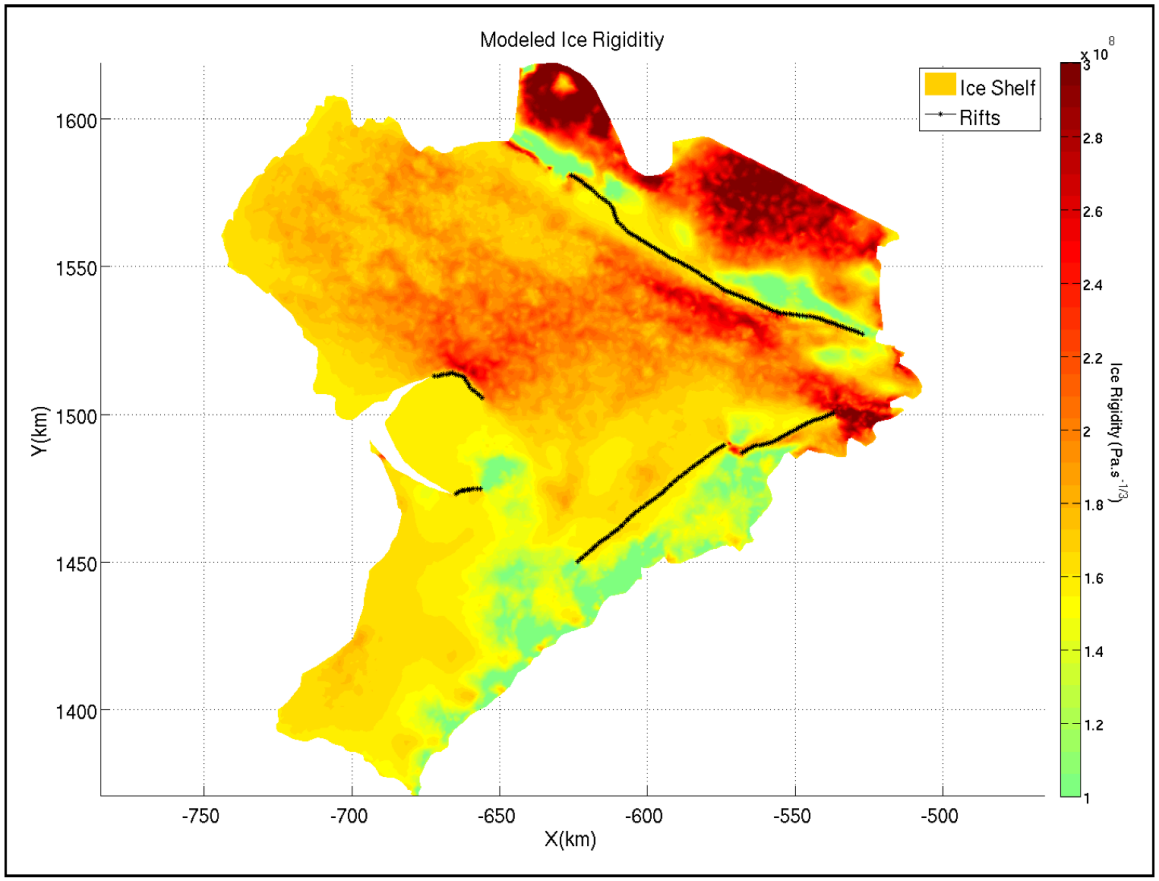
Other capabilities

- Post-glacial rebound
- Rift propagations



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Numerics

- Only triangle (2D) and prismatic (3D) elements

→ No quadrangle elements

- Only P1 (piecewise linear nodal functions)

→ No quadratic or higher-order interpolations

- Non-linear iterations based on Picard method (fixed-point)

→ No Newton iterations

- Direct solver used for full-Stokes model

→ No scalable solver (iteratif solver)

Thanks!